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Materials in Standard Costs

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Editorial Department Note

The current publication deals with an interesting problem in the relation between cost methods and procedures and the selling prices based on the costs thus secured. In many industries and in many individual instances, it is a situation which requires very careful analysis; much wrong thinking has been done on it in the past.

Mr. William L. Churchill, the author, is a consultant industrial engineer specializing upon improving returns upon capital invested in manufacturing through correcting faulty pricing principles of entire industries. With a background of varied experience in manufacturing, selling, and consultation work, his offering is based upon the results of definite application of the ideas and theories advanced.

Mr. Churchill first became interested in cost work about 1897, when as head of a manufacturing department for the Lamson Store Service Co. he was called upon to devise a cost accounting system for several of the departments. This interest in and study of costing problems and methods have been largely responsible for the successive steps in his career. He has been connected in executive capacities with the National Pneumatic Service Co., Chicago; the Schreiber and Conchar Manufacturing Co., Dubuque, Ia.; Yale and Towne Manufacturing Co., Stamford, Conn.; McKinnon Dash Co., St. Catharines, Ont., Canada. He has also served as industrial engineer and consultant with Stephen T. Williams and Staff; C. E. Knoeppel and Co.; and the McDonald-Churchill Corp. He has been director of the Arizona Vulcan Mining Co. and is President of the Weeks Engineering Corp. He is a member of the American Society of Mechanical Engineers.

The paper was presented before a recent meeting of the Chicago Chapter, N. A. C. A.

MATERIALS IN STANDARD COSTS

In the compilation of standard costs, the pricing of the values of the materials to be used in the production of the articles for which costs are desired seems to offer very little possibility for arriving at faulty conclusions in the final cost and pricing summations.

It seems to be the simplest of the major cost factors and the one in which there can be almost unanimous agreement among cost finders as to the correct figures to use, especially for our major and basic materials.

There are, however, several different practices in vogue in pricing these materials, even with standard costs, that tend to develop different cost conclusions when costs are compiled by different people for the same products using the same materials purchased at the same price. This of course is likewise true of other forms of costing and of the ordinary estimating, and when these variations in interpretations of values are summarized with their other cost elements of equal and often wider variations in interpretations, total costs and selling prices of comparable products pro-

duced by competitors with similar actual costs are widely apart.

It is not unusual to find costs of similar products calculated so widely apart that the result of one firm's calculation may be double that of another for the same line and using the same standard costs.

Not all of this difference is due to different interpretation of the prices to use in extending the values of the materials in calculating these costs but these differences are frequently multiplied by faulty practices and differences in practices of applying general manufacturing expense to materials and of applying selling and administration expenses to materials and by adding profit to materials.

The possibility of piling error on error, and thus magnifying the importance of the original error caused by pricing materials faultily, makes it vitally important that every detail connected with the costing of materials should be handled rightly.

The importance of the material factor in cost varies with its proportion of the total of cost. There are products, such as electric power produced from water power, oxygen produced from air, for which no direct materials are purchased. There are other products, such as platinum jewelry, of whose total selling price over 90% has to be expended for materials used in their production. There are many industries of whose total cost of operations from 50% to 75% is expended by them for the purchase of the materials used in their manufacturing operations.

With the more staple commodities—such as flour, fabrics, oil products, and steel—on account of the highly mechanized and continuous processes involved in their operations, conversion costs, selling and administration costs and profits combined are frequently less than the cost of the wheat, cotton, wool, silk, crude oil, and pig iron used in their operations.

These and other materials, besides being subject to distortion by variations in practices in regard to the application of overheads, burdens, and profits, are many of them subject to wide variations in purchase prices from day to day, creating an especially acute problem for the cost finder to solve. Standard costs should reduce these problems to the simplest form.

Standard material prices to use for materials whose market prices fluctuate appreciably should be the market prices prevailing on the day the products leave the legal possession of the producer. The reason for this is that all materials are worth the current market price regardless of their purchase price. The value of inventories rises and falls with the rise and fall of the market prices of the materials in the inventory.

It is appreciated that there are many materials for which there are no published market quotations to guide users in the determination of their current values, but current values should be determined and used and not the purchase price if the latter should have been higher or lower. It is also appreciated that the effect

of the variations in market prices from the prices paid for the materials used in many products will be negligible and not justify any effort to keep track of these variations. As in all other details of cost finding it must always be borne in mind that the purpose is to determine a total and not for hair-splitting of details.

Obvious as the correctness of this rule (using current market prices) may be, there is even in this enlightened day a surprisingly large number of firms which, in the pricing of their products, surrender any advantages that they may have in the form of materials purchased below market prices, and calculate their costs on the basis of prices paid for their materials.

When the market goes against them and they are unfortunate enough to have materials on hand, purchased at prices appreciably higher than the current market, they then find themselves obliged to sell their product at prices based upon the prevailing market prices of the materials required for their production.

A case in point is that of a manufacturer whose product, known as stove hardware, had as its principal raw material cast iron scrap, or pig iron. After a large fire that destroyed a considerable portion of a neighboring city, he employed trucks to help remove the debris and salvaged a large amount of scrap iron that cost him only $6.00 per ton delivered in his yards. At the time, the prevailing market price for his materials was $16.00 per ton.

Fortified with a price list of his products based upon iron costing him $6.00 per ton, the sales department immediately secured all the business that the firm could handle for a number of months and until his salvage scrap was used up.

The obvious bargains stimulated buying and dealers stocked up liberally against their future needs. Competitors even asserted that the finished hardware, wrapped and boxed, could be purchased by them for less money than their raw materials. Everything looked rosy to the manufacturer until he began again to produce with materials purchased at the market price. He found it utterly impossible to obtain any appreciable volume of business as he had already glutted his market. After two years futile struggle against the very condition that he had created, his business finally succumbed. This of course is an extreme case, but an excellent illustration of the economic reason for treating materials in standard costs at their current market prices. It is not merely correct from the standpoint of cost calculation, but necessary from the standpoint of sound business.

Very often some one manufacturer of many in the same industry forces all of the members in that industry to sell their products at a loss, simply because he happened to have on hand a supply of raw material purchased at less than current market prices and when called upon to bid for contracts for large quantities of his product, he prices according to his purchase price of the materials required.

Competitors confronted with his quotations often feel obliged

to meet them and the entire industry gets into a price war in which everybody loses money, even the offender, because when he exhausts his supply of cheaply purchased materials, he finds it difficult or impossible to get prices in advance of the price levels that he is responsible for establishing. He therefore makes products at a loss that quickly offset all that he may have gained by his previous fortunate purchase.

This is one of the reasons why many of our basic industries get into periods when it seems impossible for any firm in the industry to make any money. The growing practice of more rapid turnover of stocks is helping greatly to reduce these periods of depression. Yet there are many materials, which, because of their seasonal nature, long hauls from supply sources, or prolonged processing requirements, compel large investments by manufacturers, whose inventories are thus bound to fluctuate widely due to wide changes in the values of these materials while they are in their possession.

Surprisingly large numbers of our manufacturing industries make such profits as they do make entirely from their timely buying of the raw materials. Many firms who do not realize it would make as much money, and sometimes more than they do, simply by trading in their materials and permitting someone else to do the manufacturing. It is not at all uncommon to find that the total profit of a concern is due entirely to the increase in the inventory prices over the purchase prices of its major materials. In these instances, of course, the manufacturers, at least at inventory time, are pricing their raw materials on the basis of their market values at inventory date.

When manufacturers depend upon trading for their profits they are of course just as liable to be caught with materials purchased at excessive prices and it is very common practice with them on these conditions to price, their inventories at least, in accordance with the prices that they may have paid for these materials rather than show a loss on their books. The loss is there, however, and is bound to be reflected in the sales prices of their commodities.

The mechanical routine involved in handling changes in inventory values of raw materials whose prices fluctuate rapidly and widely, need not be as complicated as may at first thought seem. A customary and very satisfactory method is to use for cost purposes, including inventory changes, the prevailing market prices of the first business day of each calendar month, or other arbitrary period of lesser length.

Since price changes affect the values of materials included in the products that are in process of manufacture and of finished products still in the ownership of the producers, as well as the raw materials on hand, it is necessary to know the total amounts of these materials at each inventory date.

For this purpose and for other advantages that the cost finder will readily detect, a perpetual inventory of the financial value of

all materials is recommended. This inventory merely consists of a debit and credit account. To start this material inventory account, inventory all raw materials on hand, plus the raw materials that are in the in-process goods and in the finished product—including in these latter the standard allowances for waste and spoilage—at the current market values for these materials. Charge this total amount to the debit side of this account. Thereafter charge to this account all purchases made of raw materials, charging them at their market values at time of purchase. If market values differ from prices paid, take the profit or loss at the time.

As goods are billed to customers—thus leaving the producer's legal possession—the material values at current market prices of the materials in the products shipped are to be credited to the material inventory account.

In actual practice a common procedure is to collate the total shipments of each class of products at the end of each month and summarize the total material values of each different kind of material represented, thus making a single or a few credit entries to this account each month.

Other firms do this daily and thus have in front of them a perpetual and up-to-date record of the total value of their materials, including the materials that are in process of manufacture and that are in finished goods. Some firms have found this a so much more satisfactory record of their standing that they have abandoned the typical practice of operating in-process accounts and finished goods accounts, treating labor and overheads as separate inventories, a combination of the three inventories enabling them readily to determine their total inventory status at any time and even to maintain it on a daily record basis.

Supporting this material inventory it is usual to have some form of production control that insures the quantities calculated in the standard costs as being correct. When this is done, it is a very simple matter to determine at any time and to carry cumulatively a profit and loss statement showing the effect upon the profits of the business of the fluctuations in material values and how much may have been lost or gained through the hazards and timeliness of the buying of the raw materials.

Composite Materials

There is a class of materials that when purchased contain a composite in varying proportions of several elements of different values. These are commonly purchased at some unit price for the composite and it becomes necessary for reliable standard costs that all of the elements in the composite be assessed at the true standard values for each.

In this category come especially organic materials such as logs, lumber, animals, hides, feathers, etc. A log may contain 1000 board feet of material and be purchased at, say, $40.00 per 1000 ft. This log put into a lathe and turned for veneers may prove to

contain 300 sq. ft. of wide clear veneers worth $150.00 per M; it may have 100 board feet of veneers of lesser quality worth $60.00 per M; another 100 ft. of very low grade veneers worth only $20.00 per M. We have now accounted for half of the log. The remaining part is not suitable for veneers and only 250 ft. of it are suitable even for crating at $12.00 per M. The balance, 250 ft., is only usable as fuel, at say $8.00 per M, so that in this imaginary instance, from a log purchased at $40.00, the composite contained $58.00 worth of elements.

Another log in the same batch, purchased at $40.00 may have only 100 ft. of good quality veneers, worth $150 per M, and the other materials of lesser value may prove the log to have contained only $22.00 worth of elements.

It is much the same with lumber. A lot of lumber may be purchased at, say, $80.00 per M in 18 ft. lengths. The same materials in 12 ft. lengths may be worth only $60.00 and so called "droppings" of 2 ft. perhaps may be purchased for $30.00.

Obviously under these circumstances when an 18 ft. plank is cut up into 2 ft. lengths, the resulting materials are worth only what 2 ft. lengths could be purchased for on the open market. On the other hand a perfectly clear 18 ft. plank in this lot of average material may be worth $150.00 per M, if perfect lumber of this length and size selected for the purpose would bring $150.00 in the open market.

Animals such as beef animals, sheep, and hogs have a very complex assortment of values in their composition, in somewhat varying proportions, and their purchase prices usually at so much per pound aim to strike an average of the value of them all. There are elements in food animals worth many times the average price paid per pound for the entire animal, and other elements worth only a fraction of the average price paid.

With hides there is likewise wide variation in values per square area for the material cut from different portions of the hide. For example, shoes selling for $12.00, $9.00 and $6.00 per pair may have their uppers cut from the same hide and all the details of manufacture be identical except that, the uppers for the $12.00 shoes are cut from the best and most valuable portion of the hide; the $9.00 shoes from a less valuable portion and the $6.00 shoes from the least valuable part.

Certain fibers have to be purchased in bulk at an average rate per pound and re-sorted for different grades and qualities of different values and of varying proportions in the purchase.

Feathers likewise are usually purchased at some flat rate per pound, cleaned and sorted into a great variety of grades carrying widely different values.

Standard costs provide a definite means of determining the various raw material values of the different elements making up these composite materials.

Standard relationships of one element to another or of one

grade to another need to be developed with many of these materials. The lack of understanding of variation in values of these elements is a cause for wide variations in selling prices established by manufacturers of the same commodities using these materials.

For example, one furniture manufacturer making a wide range of products may purchase full length lumber at $80.00 per M and charge all of his product at this rate for all of the lumber used in their construction. He may make a line of chairs out of his shorter pieces and even cut his full length lumber into pieces for the purpose and charge the same rate of $80.00 per M in the cost of this product.

A competitor making chairs only may purchase short length material at say $50.00 per M and even for his smaller parts he will use short lengths that he purchases at $30.00 per M. His competitor making a general line may with apparent good cause accuse him of being a price cutter when as a matter of fact the difference in desired prices may be entirely due to the manufacturer of the general line failing to differentiate values of his different sized pieces of lumber used. On the other hand this same manufacturer of a general line may include in this line articles that require especially long and selected lumber that he will pick from his general stock and charge in at $80.00 per M. He may have a competitor specializing on davenports, settees, or other products calling for lengthy and clear material that because of its selection he has to pay $120.00 for. He, of course, finds it difficult to compete with the general manufacturer, even though he may have exactly the same actual costs. The difference in prices desired that will be obtained by the difference in lumber values used in their costs compels the specialist on large furniture to reduce his prices to those of the general manufacturer; the latter in turn finds he has to sell chairs on a basis of the prices of the chair specialist so that neither the general manufacturer nor the manufacturer of large furniture can make a fair profit. This condition, due entirely to lack of proper understanding of material pricing principles, can and does create price warfares whereby even the chair specialists are forced to sell their products below what they should obtain for them.

The National Association of Cost Accountants can perform a very splendid economic service by bringing about an understanding of these principles of pricing materials in accordance with their elemental values, rather than the very common practice of using their composite values for all products made from them.

This problem is very well understood and quite generally handled on a proper basis in many of the leather industries although there is room for some further standardization in some of the leather working trades.

Generally accepted standards of relative values have not been worked out in many of the other classes of composite materials.

The writer has done some work in this line with lumber and veneers and developed a basis for determining values of lumbers

and veneers for various lengths when the composite price is given. This work was originally done for the Plywood Manufacturers Association and published in a report of this association dated March 9, 1920. This table and an explanation were also published in *Management Engineering* of July, 1921, this in turn copied by permission and printed in H. D. Potter's work, Cost Finding Principles for Furniture Factories, published by the Periodical Publishing Co., Grand Rapids, Michigan.

Additions to Purchase Prices

To the purchase prices should always be added—specifically wherever possible—incoming freight and cartage so that the price includes its cost up to its receipt by the purchaser. This practice is very general and yet there are firms who throw all freight and incoming delivery charges into a general expense account. Ordinarily this practice creates no serious disturbance of total costs but occasionally it is the cause of greatly increasing the cost of certain products having comparatively little material but a great deal of conversion cost in their makeup. Offsetting this the practice may unduly favor products whose costs run chiefly to heavy materials.

A case in point is that of a wax paper manufacturer whose incoming freight on his raw materials aggregated nearly 8% of his total cost of doing business. This was thrown into general manufacturing expense which in turn was pro-rated to all products on the basis of its ratio to direct labor. The result was that his very heavy waxed paper requiring only 10% as much direct labor per 100 pounds of product as his light weight multiple colored printed and cut paper only had one tenth of the freight charge of the latter. Based on averages, the heavy paper was being favored with costs by being charged only 20% of the actual freight paid for its delivery to the firm and the other extreme was being charged with five times the freight with which it should have been charged, if the freight had been placed specifically upon the material received.

It is realized that there are many items of incoming freight and cartage, express, etc., that it is impracticable to attempt to segregate against the various items to which they might be assigned. As a rule the total of these amounts is relatively small and can very properly be merged in some general account rather than go to undue expense in the effort to segregate them. Here again good sense must prevail; the important thing is to be particular, if the total involved is sufficient to appreciably affect total cost of the units under consideration.

Handling charges, of an arbitrary nature, should not be added to prices of materials. Unloading and storing of material in many industries can be very definitely standardized in regard to their labor cost and the overheads pertaining thereto and in these cases

these operations should be treated exactly the same as other labor operations and not be considered as a part of material costs.

Many firms establish arbitrary ratios to purchase prices, such as 5% or 10% and in some instances as high as 35% to their purchase prices as a sort of a play-safe proposition to insure covering all costs pertaining to the handling, storage, financing, etc., of their purchases.

There is no justification for this procedure with standard costs. Frequently this practice alone distorts total costs so as to penalize severely the products made from the more expensive materials in favor of products having a smaller proportion of material costs, that are not at all in accord with the facts.

There are industries which buy no materials, although handling materials furnished by customers for processing, and which, therefore, cannot place handling charges upon a basis of a ratio to the material values. It is true that these industries, such as job dyers and finishers of fabrics, do not have capital invested in the materials but do have the costs of insurance liability and the costs of actual unloading, storage, etc., that must be cared for through other accounts than by addition to material values.

There are firms which manufacture a part of their production from materials that they purchase and they manufacture part of their product on contracts for customers who supply their own raw materials. When these firms use arbitrary ratios to purchase prices to add as so called handling charges, they automatically penalize the prices of their own products in favor of the contract products for which the customers furnish the materials.

The cost of the physical handling of materials should invariably be included in processing costs by direct labor charges to such extent as is practical and by merging into general manufacturing accounts when the other method may be impractical.

Interest on the investment in materials, insurance and taxes, can very properly be added to the purchase prices of the materials.

When these factors or any of them are added, they should be based upon the standard turnover of materials involved. While there may be wide variations in the period of turnover for different classes of materials, it is good practice to use standard rates.

For example: A manufacturer may have a standard practice of maintaining in his inventories materials aggregating one-sixth of his annual purchases. This means an average turnover of materials every 60 days.

If, because of widely varying values of materials in different products, he desires to charge each with its proper share of interest on the investment, taxes, and insurance, he would summarize the annual charges for these cost elements and divide by 6 to determine the rate to add for his carrying charges on materials.

Assuming that he wishes to charge the usual 6% for interest on his investment, and that his taxes average 2%, and his insurance

averages 1% upon his investment, he would arrive at a total of 9% "carrying charges" per year that divided by 6 would give him 1.5% to add to the purchase price of all of his materials to take care of his average carrying charges.

Should he have certain exceptional materials which, due to seasonal conditions, import requirement, etc., require long seasoning, aging, or other prolonged processes, these materials may properly have added to them a rate corresponding to their specific turnover such as 4.5% for 6 months, 18% for 2 years, etc.

With a great many manufacturers the proportion of material costs in the various products are so nearly uniform that they prefer to ignore this factor as a part of material costs and include the carrying charges in a general expense and profit account.

The practice is a sound one, however, and involves no difficulties, being simply a matter of standardizing the rates to add to purchase prices in accord with standard turnover. In fact it is one of the arguments in favor both of Standard costs and of the speediest practicable turnover. Standard costs determine the financial consequences of differing rates of turnover, thus showing where volume buying ceases to be profitable and hand-to-mouth buying becomes profitable.

Low purchasing prices for huge quantities of raw material are often proven costly through the cost of carrying them for abnormal periods. In one instance a manufacturer was hypothecating his receivables and was seeking additional capital to carry on his business when a standard cost analysis disclosed that in his eagerness to buy materials cheaply he was carrying the equivalent of eleven months' supply and at a cost that was ruinous because of the relatively large proportion of material cost in his total costs.

Based upon the information disclosed by the standard cost analysis, this manufacturer restricted his buying until his turnover was reduced to one month instead of eleven, thus liquidating double the amount of the additional capital that he was seeking and placing his business upon a profitable basis without recourse to outside aid for finances.

The Fallacy of Adding Manufacturing Expense to Materials

One practice that is utterly indefensible still persists to a remarkably large extent, despite a great deal that has been preached against it. This is the practice of adding the cost of labor and materials together, then applying manufacturing expense on the basis of the ratio that the latter bears to this prime cost total.

The fallacy of this form of reasoning cannot be too emphatically stressed nor too generally disseminated by the National Association of Cost Accountants. It not only misleads the individual manufacturers who use it, but is often the cause of depressing prices of some commodities of entire industries.

To illustrate this point a case of a Plywood manufacturer is cited. His firm in competition with many others was the only one

that still clung to this primitive method despite the fact that he had a very complete cost system based upon standard principles.

Plywood panels are made of widely varying values of materials ranging from a few cents per square foot to $1 or more. This party having arrived at a standard ratio to total prime costs for his general manufacturing expenses was, by adding this ratio to his panels using the cheapest grades of veneers, underpricing all of his competitors more than 25%. Naturally he began getting a large volume of this class of business and getting it away from competitors in the belief that he was producing cheaper than they. They in turn, to save their waning business, arbitrarily met this man's prices on this class of goods and all who manufactured the cheaper grades found themselves facing deficits.

He, on the other hand, when he found that his expensive panels were priced higher than his competitors naturally assumed that they were arbitrarily lowering their price to "get him" and he retaliated by meeting these prices and cutting them still more. The result was an industry suffering for lack of reasonable profits, due chiefly to one firm's adhering to the falacious principle of adding general manufacturing expense as a ratio to materials and labor.

It takes but little reasoning to make it clear that the various items of cost entering into general manufacturing expense bear no relation to the value of the materials that are being processed.

The Fallacy of Adding Selling and Administration Expenses to Materials

One very common practice of manufacturers that distorts selling prices out of their true proportions is that of adding selling or selling and administration expenses on the basis of their average ratio to the total of manufactured costs, including in these costs the costs of materials.

The theory back of this fallacy is that selling costs parallel the total costs or that they parallel selling prices. This is not the case and manufacturers are barely beginning to realize that the practice is faulty. The quicker it is corrected, the quicker will manufacturers be able to arrive at comparable costs and comparable prices for comparable goods.

Selling costs have no definite relation to the total costs of products or to their total selling prices, even in the same line of production. This has been conclusively demonstrated by a study of the selling costs of a dozen manufacturers making a single line of products with varying proportions of material values entering therein. To illustrate the point we will call these products wire nails. One firm whose product was chiefly in the larger sizes and whose total annual manufacturing costs consequently bulked large in materials was adding 8% to its total manufacturing costs for its selling and administration expenses. A rival firm whose principal product was confined to smaller sizes of wire brads found it necessary to add 35% because its total of material consumption in a

year was but a relatively small proportion of its total cost. The selling and administration expenses of the other firms ranged in between these two according to the average sizes that each happened to produce. When material costs were eliminated from total costs, the ratio that selling and administration expenses bore to the remainder of manufacturing costs (or conversion cost) was startlingly uniform. They varied so slightly from each other that the variations could readily be explained by differences in salaries paid and relative efficiencies, etc. Similar comparisons in other and more complex lines covering some 19 different industries and ranging from three to twelve firms in each, have conclusively proven that selling and administration expenses should not be added to material costs either by direct ratio thereto or by ratio to the combined cost of labor and materials.

Referring again to the nail manufacturers, it can readily be understood why the party specializing upon smaller nails with his 35% selling expense found his business slipping away to people whose average selling expense ratioed less to their total cost than his. It can also be understood why the firms quoting on the heaviest nails found themeslves outbid by the specialists on these nails who continued to make good profits because they kept their equipment going on only the coarsest goods. None of their competitors were able to make a reasonable showing, as quotations by the firm making the coarsest nails would be below what they should obtain for their medium and finer products and they would feel obliged to meet these prices to hold their business.

The Fallacy of Adding Profit to Materials

What has been said in regard to the fallacy of adding manufacturing expense and of adding selling and administration expenses to material costs, applies with equal force to profit, not only to gross profit but to net profit.

Except for a few dealers in materials who introduce a manufacturing operation or two for the sake of facilitating the sale of these materials, manufacturers are not in the business of jobbing or selling the materials used in the manufacture of the product.

Manufacturers have for sale their ability, skill, training, and experience in converting materials from one form to other forms that may be desired by their customers.

When customers furnish the materials upon which manufacturers may exercise their ability and skill, they have no opportunity to collect a profit on the materials supplied by the customer but must collect all their profit upon their applied effort.

Further reasoning is that the suppliers of the materials used by manufacturers have already collected profit in selling to the manufacturer. When he profits upon this profit he automatically reduces the amount of profit that he tries to collect for his service and consequently finds that the larger the proportion of the material in the cost of any of the products, the less of it he can sell,

while the smaller the proportion of material in his product, the more easily he finds a market.

The very insidiousness of the results of applying this almost universal method of profiting upon materials is its greatest danger. It has caused the wreckage of many fine old established industries whose owners have never even realized the cause.

A classic example, idealized somewhat to illustrate this fallacy, is that of a plain band wedding ring:

	Alloy Ring	*Gold Ring*	*Platinum Ring*
Material Cost	$0.15	$4.50	$27.00
Labor	.20	.20	.20
Genl. Expense (150% of labor)	.30	.30	.30
Total Cost	$0.65	$5.00	$27.50
Standard Profit 20%	.13	1.00	5.50
Sale Price	$0.78	$6.00	$33.00

A review of these three supposititious but typical cases will indicate the possibility of many undesirable happenings to such a business where profits are applied on a basis of a ratio to total costs, thus automatically adding a profit to the purchase price of the materials.

Of course with a standard profit of $5.50 upon a platinum ring costing but $0.50 for conversion effort, the manufacturer could not hope to sell many platinum rings. On the other hand had the profit not been based upon the materials the price for this ring could have been made sufficiently attractive to have encouraged a large sale.

The worst feature, however, is the small profit of $0.13 for $0.50 worth of conversion effort, collected on the alloy ring. The low price for this ring creates a demand that gradually supplants all other classes of products so that total profits lessen year by year even with a growing force of employees and increasing investment in plant and facilities to keep up with the growing demand for the cheap product.

Gross Profit

When manufacturers combine net profit with selling and administration expense and, as not infrequently happens, with general manufacturing expenses under the term of gross profit, they add error upon error, when they ratio gross profits to total manufacturing costs or to total prime costs in which are included the costs of materials.

In one recent case coming under the writer's observation, it is a habit among eight manufacturers of the same line to figure prices by first determining the total costs of materials entering into their

production and then adding an arbitrary ratio to arrive at selling prices. Absurd as this practice sounds, it is seriously in use by many manufacturers. One of the eight firms mentioned had after several years of operations developed the fact that he needed to add 100% to the cost of his material to arrive at a selling price that would pay all the costs of manufacture and distribution and leave him a small profit. So habituated had he become to this practice that when a new design was developed, using only half as much material but requiring exactly the same other costs, the firm in all seriousness figured that they would be able to sell at 50% of the former price.

Fortunately before marketing a great deal of this new product they adopted the principles of standard costs and the error was corrected before serious harm was done to them.

Another group of manufacturers, one which has adopted uniform costing methods and which, therefore, arrives at approximately the same prime costs (labor and materials) for comparable products, had each developed its own ratio to these prime costs that each needs to cover its general manufacturing, selling and administration expenses and profit. Their products have wide ranges of values of materials, some of the firms specializing more or less on the cheaper grades, others running strongly on the more expensive grades, and a few making quite a general assortment.

All, however, are adding gross profit to their materials in the form of the ratio that gross profit bears to the combined labor and material costs.

These manufacturers get together in gatherings and gravely discuss the different ratios they use. One manufacturer will state that he uses 62%, another will marvel how it can be done when he has to have 150%. The difference of course is in the relative proportion of materials used in the year's operations to the total cost of the operations of the different firms.

The firm needing 150% has been accustomed to specialize on goods using cheap materials and today is in the hands of its bankers because it simply cannot compete with firms competing with them, some of which add as little as 62% to their prime costs in arriving at quotations.

The latter firm, of course, has always specialized on quality products using expensive materials and its ratio is naturally less. It, however, is always in danger of becoming flooded with unprofitable work because it habitually uses the same ratio on all grades upon which it is desired to quote.

Summary

Sufficient has been said to indicate not only the technically right and wrong ways for the handling of materials in standard costs, but also to indicate the real menace that exists today in the faulty handling of this item in arriving at selling prices.

Matters should be entered in standard costs at their market values upon the date of transfer to the legal possession of customers.

To the market prices of materials should be added standard wastes, including standard allowances for spoilage and for obsolescence if these are standard requirements.

To the sum of these should be added interest upon investment, taxes and insurance in accordance with the standard rates for these carrying charges and the standard period of turnover of the materials.

There should be no other additions to material costs to arrive at standard costs of products. There should be no addition for manufacturing expense in the form of a ratio to the material values.

There should be no selling expense added to the cost of materials to arrive at selling prices.

There should be no administration expenses added to the cost of materials and there should be no profit, either net or gross, added to the cost of materials either directly or in combination with the cost of labor or other cost elements in arriving at selling prices of manufactured products.

General Remarks

The general adoption of the principle of treating manufacturing costs, including the cost of distributing manufactured wares, as the basis for control of manufacturing operations and profits, and to treat materials as something for which the manufacturer has merely acted as an agent to accommodate his customers in securing these for them, will affect many desirable economic improvements.

Aside from the soundness of the principle from an accounting standpoint, it at once encourages production and consumption of quality products and discourages the manufacture and distribution of products made from inferior materials.

To illustrate this point, the case of a manufacturer of upholstered furniture may be used. The typical practice in this industry has been to determine manufacturing cost by summarizing labor, materials, and general manufacturing expenses and then adding 50% for gross profit to cover the cost of selling and administration and to provide net profit.

This practice works out as follows: A typical suite of upholstered furniture may contain fifteen yards of covering fabric ranging in values from $2.00 to $10.00 per yard and, therefore, amounting to anywhere from $30.00 to $150.00 per suite for this item alone, making a total difference in cost between the cheapest and best grades of covering used (as all other materials and cost are identical) of $120.00. This means expensive fabrics can be sold at $120.00 more than the suite that has the cheapest fabric and yet earn as much for the manufacturer for his effort.

Adding 50% has made a difference in the selling prices, however, for the covering fabric alone of $45.00 for the cheapest materials and $225.00 for the most expensive, thereby making it necessary for the manufacturer to charge $180.00 more for the best suite than for the cheapest, when in reality there was only $120.00 difference in the value.

Manufacturers in this line are beginning to recognize this situation and many are quoting prices on their products "in muslin" and giving customers a choice of fabrics at the yardage prices for those fabrics and adding only the price for the chosen fabrics to the price of the furniture in muslin.

Many producers of metal products now made from iron and steel will enlarge their output of products containing more expensive and many times more suitable materials as copper, zinc, aluminum or their alloys and increase the use of galvanized and other protectively coated materials as substitutes for the more susceptible and less permanent plain steel and iron goods.

It is not uncommon to find that the various additions to sheet iron and steel products for general expenses and profits aggregate 125%. When these manufacturers are asked to quote on the same product made from aluminum, bronze, or copper or other more expensive materials, their habitual method of enhancing the material prices in their costs makes their prices prohibitive and discourages their production.

This is a very common failure with foundries and with sheet metal workers and automatically restricts their trade to product and work having a comparatively small proportion of material cost in their calculations.

When "list" selling prices are arrived at through these faulty additions of profit to material costs and these list prices are subject to trade discounts the larger the proportion of materials in the total cost of the product the greater the sacrifice occasioned by a discount.

A pound of nails listed at eight cents, containing three cents worth of materials and selling at a 40% discount, leaves the manufacturer only $.018 per pound for manufacturing and distributing these goods and paying his stockholders a profit. This same 40% discount, applied to the finer nails having a list price of twenty-five cents per pound and containing three cents' worth of material, leaves the manufacturer twelve cents a pound for the same purposes. Where material costs of some of the products run from 70% to 80% of the total price, although the average may be well under 50%, trade and cash discounts frequently enable the customer to obtain his finished products for less than what the manufacturer paid for the raw materials entering therein.

It is this phase of faulty treatment of materials in cost that has created the impression in the mind of many manufacturers that manufacturers whose products are composed of materials that absorb the larger portion of their costs are in a precarious business.

Many will assert that it is impossible for a manufacturer to operate profitably if he has to spend over some definite percentage, such as 75% or 80% of his receipts for these materials.

There is nothing inherent in this situation that is responsible for profits or deficits. It is entirely a question of the proper treatment of materials in arriving at their selling prices.

It is the many possibilities of price distortions that can be caused by faulty treatment of materials in cost that makes this single cost element the most important one on which all manufacturers should have common understanding as to its proper treatment in arriving at the sale prices of their products.

It matters not what type of cost system or system of procedure is used, if materials are not considered correctly, in all their bearings upon the final prices and quotations, these will not be correct.

It is not only important that materials be treated correctly, it is vital.